100 Months of Upper-Ocean Coastal Upwelling Computed From Alongshore Wind-Stress in the Southeast Pacific Ocean

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The European Remote-sensing Satellites (ERS-1/2) have provided scatterometer measurements since 1991. Several ERS surface wind vector data products are available and, in this paper, we used the product created by the Institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER) Department d'Oceanographie Spatiale (CERSAT). Monthly mean 0.5-deg x 0.5-deg wind vectors components are computed within 4 degrees of the coast, where the components are in the alongshore and onshore-offshore directions. A 5-year "normal" interval is defined, and monthly mean anomalies are computed. Along the west coast of South America equatorward of approximately 40S, the alongshore wind stress is directed towards the equator, producing coastal upwelling and yielding an indirect estimate of upper-ocean vertical velocity. Latitudes of relative maxima at 30S and 15S were separated by a minimum at 20S; the maximum at 30S was two times greater than that at 15S. At 15S, the maximum occurred in July; at 30S the time of maximum alongshore wind stress was October. During the 1997 El Nino, the strength alongshore wind stress at the coast nearly doubled compared to climatology. At the coast, the increase in wind stress relative to the climatology was larger in intensity and occurred for more months than 100-150 km offshore. The notion that coastal upwelling ceases during El Nino is dispelled; previous evidence had been confined to isolated coastal wind-measuring locations. The coastal intensification of the alogshore wind stress is produced by coastal upwelling. The response of the coastal ocean regarding sea surface temperature, sea surface height, and phytoplankton pigment concentration will be described.